PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/JP2004/009077	22.06.2004	27.06.2003

International Patent Classification (IPC) or both national classification and IPC
G03F7/32

Applicant
TOKYO OHKA KOGYO CO., LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☐ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/JP2004/009077

IAP20 Rec'd PCT/PTO 22 DEC 2005

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ in written format

   ☐ in computer readable form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (SEPARATE SHEET)

International application No.
PCT/JP2004/009077

IAP20 Rec'd PCT/PTO 22 DEC 2005

Re Item V.

Reference is made to the following documents:

D1: US5985525
D2: EP272686
D3: EP323836

To novelty:

None of the cited prior art documents describes a combination of an quaternary ammonium alkaline agent in combination with a sodium salt of a substituted diphenyl ether sulfonate as surfactant in a developer composition for (photo)resists. Novelty in the sense of Art. 33(2) PCT is acknowledged for the subject-matter of claims 1-3.

To inventive step

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-3 does not involve an inventive step in the sense of Article 33(3) PCT.

The closest prior is D1, which is believed to be similar to the document cited by the applicant in the description on P.2. It describes a developing composition for resists comprising a quaternary ammonium hydroxide as alkaline agent in combination with a surfactant based on ammonium salts of a substituted diphenylether sulfonic acid.

The present application differs from this prior art in that a metal salt, preferably sodium, potassium or calcium is used as cation instead of ammonium in the surfactant. In the examples it is shown that the dissolution time required for removing a resist is shortened when comparing with the surfactant of D1. According to the description, the improved wetting will have a positive impact on selectivity and thereby yield better profiles and improve the resolution.

The problem which had to be solved according to the description can be defined as overcoming the shortcomings of the surfactants used in D1, which have less than optimum properties as far as wettability and enhancement of dissolution are concerned.

It should be noted that anionic surfactants with quaternary ammonium counter-ions have been chosen in the production of semiconductors because of the sensitivity of the substrates to metal impurities. Traditional surfactants for developing compositions in fields such as printing plates or printed circuit boards are however mostly sodium salts of a variety of anionic surfactants, including sodium salts of substituted diphenylether sulfonates. The introduction of metal-free compositions for semiconductors has never been based on performance considerations as far as the development itself is concerned, but has been imposed by the nature of the underlying substrate, as acknowledged by the applicant in the description. D1 clearly mentions (column 1, bottom) that the use of these ammonium surfactants is not the ideal solution as far as the development properties are concerned. And the examples of the application show that the ammonium salt even has a detrimental effect on the dissolution time when comparing with a composition free of surfactant (comp. Ex.2).

The person skilled in the art who is aware of the evolution of the general technology would, when confronted with a problem in a process where metal contaminations are of no major concern, consider the use of compositions which have already shown good performance in applications where naphtoquinone diazide based resists coated on a metal are developed. D3 (as well as D2) clearly mention that the choice of the alkaline agent includes metal-free as well as metal containing compounds, while sodium alkyl diphenyl ether disulfonates are among the recommended surfactants. To adapt these general recommendations to a particular application as defined by the present claims is well within the reach of the person skilled in the art, without requiring any inventive activity.